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Prevalence of depression symptoms and its influencing factors in late pregnancy in urban areas of Hengyang City, Hunan Province, China.

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Abstract

Objectives: To evaluate the prevalence of depressive symptoms and its influencing factors in Late pregnancy.

Setting: A cross-sectional survey was conducted on late pregnant women. Participants came from the community in urban areas of Hengyang City.

Participants: 819 pregnant women participated in the survey. Since 6 of them did not complete the questionnaire survey, there were only 813 pregnant women in third trimester.

Outcome measures: Perinatal depression symptoms evaluated by using the Patient Health Questionnaire-9 (PHA-9), and perinatal anxiety symptoms evaluated by using the Generalized Anxiety Disorder Scale-7(GAD-7). Sociodemographic variables, obstetric characteristics, lifestyle behaviors, family factors, social support, sleep quality, and self-efficacy were obtained through structured questionnaires.

Results: The prevalence of depression symptoms was 9.2% in late pregnancy. Age between 25 to 29 years (OR = 0.398, 95% CI 0.16,0.991), the relationship with her mother-in-law (OR=5.309, 95% CI 1.122,4.184), artificial insemination (OR=4.339, 95%CI 1.492,12.623), no exercise during pregnancy (OR=2.666, 95%CI 1.177,6.039), low self-efficacy(OR=4.253, 95%CI 1.518,11.916), low social support (OR=2.371, 95%CI 1.206,4.661),poor sleep quality (OR=2.134, 95%CI 1.131,4.027), existence

of anxiety symptoms (OR=17.654, 95%CI 8.494,36.689) were associated with depression symptoms.

Conclusion: the study reported low rates of depression, and affected by life styles behaviors, family factors and psychosocial factors. To prevent mental disorders of pregnant women, early screening for mental disorders, promotion of healthy lifestyles, mental health care during pregnancy, and improved family and social support should be carried out during pregnancy nursing.

Keywords: Depression symptoms; Late pregnancy; Prevalence; Influencing factors; China

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Article Summary

Strengths and limitations

Strengths:

1. This study investigated the mental health status of pregnant women after excluding pregnancy complications, and explored a wide range of influencing factors, including psychological, physiological and social aspects.

2. This study was a larger sample size than other studies in China, and the sample was from the community, avoided hospital bias.

Limitations:

1. The disadvantage of this study is that the cross-sectional study cannot determine the causal relationship between the influencing factors and depressive symptoms.

2. the participants' recall may lead to recall bias.

What this paper adds

the study reported lower rates of depression than other country. Biological, psychological and social factors all have different degrees of influence on depression symptoms. For the age as contradictory points, this paper reports that 25-29 years old is a protective factor for depression symptoms during pregnancy. As a special factor in the developing world, pregnant women who not that close to their mothers-in-law were more at risk for depression symptoms.

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1. **Introduction**

Pregnancy women undergo role, physiological and psychological changes. Physiological problems may occur during pregnancy, such as constipation, sleepiness, physiological dyspnea, and hormone level fluctuation, while physiological discomfort, hormonal effects and changes in social roles may cause cognitive, behavioral and emotional changes in pregnant women, resulted in mental health problems. and is likely to continue to postpartum, lead to more serious psychological health and fetal adverse outcomes, developmental problems [1 2]. So it is of great significance to consider prenatal mental health status and determine its potential influencing factors.

Currently, there was a wide range of discussions on prenatal depression. However, the prevalence rates of these conditions were different in different countries based on their measurements and culture background variation. A meta-analysis of 74 studies of 41,480 women in 2016 reported that the incidence of combined antenatal depression symptoms was 8.4% (95% confidence interval (CI): 7.2,9.6%)[3]. A study conducted between May 2017 and June 2018 at shalamar hospital found that the positive rate of depression symptoms was 40.89% based on the Goldberg depression scale among women seeking prenatal care in the third trimester of pregnancy[4].

Associated factors for depression in pregnant women mainly included four domains: (1)socio-demographic factors; (2)pregnancy characteristics; (3) personality characteristics and (4)psychosocial factors. Sociodemographic factors such as age, for example, a study on depression symptoms of pregnant women in middle and third trimesters showed that the younger they are, the higher positive rate of depression symptoms they have[5]. pregnancy characteristics such as planned pregnancy [6] and history of abortion[7]. personality traits such as low self-efficacy, was related to prenatal depression[8]. psychosocial factors such as socioeconomic status, social support and life events were associated with mental health during pregnancy [9].

Existing research on depression were more focused on postpartum, however, reports of depression symptoms in the late pregnancy were less common. Even though there were few studies have investigated the mental health status and its related factors among the third trimester pregnant women, most of them were explore that situation from single dimension, and minor specimen. Therefore, the purpose of current study was to describe the prevalence of depression symptoms in the

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third trimester of pregnancy, and to comprehensively analyzed its influencing factors. It may provide scientific basis for the evaluation of mental health status in pre-pregnancy examination program and mental health care service, so as to prevent the symptoms of depression in pregnant women.

2. Methods

2.1. Design and participants

This was a cross-sectional survey, using multi-stage cluster random sampling. There was 5 administrative districts in Hunan province, and one street was randomly selected in each district. Then, 14 communities were randomly selected according to a ratio of 1:3, including 4 communities of Zhengxiang street, 3 communities of Qingshan street, 3 communities of Baishazhou street, 2 communities of Guangdong road street and 2 communities of Zhurong street. A total of 819 pregnant women in the third trimester of pregnancy were enrolled, who lived in urban areas of Hengyang for more than 6 months, signed informed consent. The study period was from July to September 2019, participants completed the survey by filling in a paper or electronic WeChat questionnaire after obtained informed consent. Pregnant women in labor and didn't complete the questionnaire, and with history of major organic diseases were excluded, the final study included 813 pregnant women, with an unresponsive rate of 0.7%. In fact, 819 pregnant women participated in the survey, but 6 of them did not complete the questionnaire survey. In fact, 813 pregnant women were analyzed, excluded missing values.

2.2 Measurement

The self-report questionnaire was used to obtain demographic information of pregnant women, including age, nationality, marital status, education and their husband, occupation and their husband, medical expenses payment methods.

Pregnancy characteristics included parity (0,1,≥2), method of pregnancy (Artificial insemination/Spontaneous pregnancy), whether planned pregnancy, pregnancy complications (Including gestational hypertension, gestational diabetes, intrahepatic cholestasis, cervical disease),

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number of abortions (0,1,≥2), whether regular antenatal examination.

Lifestyle included BMI，smoking, drinking, exercise. BMI was based on the pregnant woman's self-reported height and weight before and after pregnancy，the China's classification of Thin (BMI<18.5 kg/m²), normal weight (BMI of 18.5-23.9 kg/m²), overweight (BMI >23.9 kg/m²). Smoking was defined as an average of one cigarette a day for the past year. Drinking was defined as drinking alcohol on average once a week. Exercise was defined as walking, yoga, etc. during the past week, Yes or No.

Depression symptoms in the third trimester of pregnancy were assessed using the Patient Health Questionnaire (PHQ-9). It has been widely used in clinical and observation studies with good reliability and validity. There are 9 items in this questionnaire, and the score of each item is set to 0-3, with a total score of 27. The higher the score, the more obvious the depression symptoms are, the total score ≥10 is considered to be Depression symptoms[10 11], with a Cronbach's α coefficient of 0.773. Generalized Anxiety Disorder scale-7 (GAD-7) was used in this study to evaluate the Anxiety of the elderly in institutions. This table was developed by Spitzer et al. 2006 and consisted of 7 items for screening generalized anxiety disorder[12]. Participants were asked if they had experienced seven symptoms in the past two weeks, each item being scored on a scale of four, "0= not at all", "1= days", "2= more than half days", and "3= almost every day", with a score ranging from 0 to 21. Studies have shown that using a cut-off score of 10 is a good way to distinguish anxiety from non-anxiety[13]. In our study, the Cronbach's α coefficient was 0.773.

Family factors include Per-capita monthly income, family function, the relationship with mother-in-law and experience of domestic abuse. Family function was assessed using the Family Adaptation Partnership Growth and Resolve Index (APGAR). APGAR scale contains five items and five dimensions, respectively reflecting the adaptability, cooperation, maturity, affection and affinity of family functions. Each item was scored using a 3-point likert scale, with a total score of 0-10, with a score of 7-10 indicating good family function, 4-6 indicating moderate family function disorder, and 0-3 indicating severe family function disorder[14]. APGAR is widely used and has good reliability and

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validity in pregnant women in China[15], with a Cronbach's α coefficient of 0.876 in this study. The Abuse Assessment Screen (AAS) was used to assess domestic violence during pregnancy. Eight items were used to assess exposure to domestic violence in the past year and during pregnancy, including physical, emotional and sexual violence. The respondents answered 'yes' to item 3/4/5/6/7, the total number of times of abuse was more than three times, subjective pain, and the three conditions were considered to have experienced domestic violence[16]. Research shows that AAS questionnaire has good reliability and validity in pregnant women, with a Cronbach's α coefficient of 0.685 in this study.

Social Support Rating Scale (SSRS) [17]was used in this study to evaluate the status of Social Support for pregnant women, which introduce by Xiao and included objective support, subjective support and the availability of support. The higher score means higher social support. The total score less than 39 in this study was consider as low social support. The scale has a good reliability and validity, with a Cronbach's α coefficient of 0.705 in this study.

This study used the Pittsburgh sleep quality index (PSQI) to evaluate maternal sleep quality. The total score of PSQI is between 0 and 21 points, and the higher the score, the worse the sleep quality. PSQI score≤7 was rated as "good sleep quality", while PSQI score >7 was rated as "poor sleep quality". Studies have shown that PSQI scale has good reliability and validity in evaluating sleep quality [18], and the Chinese version of the PSQI questionnaire has been widely accepted as a sleep quality assessment method in mainland China, with a Cronbach's α coefficient of 0.789 in this study .

Self-efficacy Scale (GSES) was used to evaluate pregnant women's self-efficacy. GSES was developed by German health psychology and clinical experts Ralf and Schwarzer, and translated into Chinese by JianXin Zhang [19]. This scale is a single-dimension scale with 10 items. Each item has 4 options: totally incorrect, moderately correct, mostly correct and completely correct, and they are marked as l, 2, 3 and 4, with the total score ranging from 10 to 40. The total score is divided by the total score of 10 items into low level (0-2), medium level (2.1-3), and high level (3.1-4). The higher the score, the better the self-efficacy is. The Cronbach ' α coefficient of this scale was 0.898 in this study.

2.3 Ethical considerations

The study was approved by the Ethics Committee of the Xiangya school of public Health prior to the

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field investigation, and all respondents volunteered for the survey.

2.4 Statistical analysis

SPSS version25.0 was used to collate and analyze the data, Continuous variables were converted into categorial variables by referring to literatures and combining research purposes, and expressed as n%. Chi-square test and Fisher's test were used for univariate analysis to compare the characteristics of depression and non-depression. Variables with $P < 0.05$ in univariate analysis were included in multivariate binary logistic regression.

2.5 Patient and public involvement

Patients and the public were not involved in the design of this study.

3. Results

3.1 sample characteristic

All participants aged 17-54 years (mean=29), 67.1% of pregnant women Pre-BMI was normal, most in the state of marriage (95.4%), more than half of the highest educational for college/university and above(58.1%), 70% of households per-capita monthly income was between 3001-7999, the vast majority (95.9%) of pregnant women was conceived naturally, more than half (59%) was in a planned pregnancy, 41.6% was pregnant for the first time, more than half (64.0%) of pregnant women was no history of miscarriage, 91.4% of participants exercised during pregnancy. 75.4% of the pregnant women had good sleep quality, 60.9% of the self-efficacy was in the medium level, 16.5% was in the high level, 60.4% of the pregnant women had good family function, most of the pregnant women (90.5%) did not experience violence during pregnancy, more than half (64.3%) of the pregnant women had a good relationship with their mother-in-law, more than half (54.9%) of the pregnant women's social support rating scale score ≥39. In our study, the prevalence of depression symptoms and anxiety symptoms was 9.2% and 7.9%, respectively. The results were shown in Table 1.

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Table 1

Characteristic of samples and Distribution of emotional problems(N=813).

Characteristic	Total n(%)	No Depression n(%)	Depression n(%)	*p* Value
N	813(100.0)	738(90.8)	75(9.2)	
Age				**0.017**
≤24	115(14.1)	100(87.0)	15(13.0)	
25-29	366(45.1)	343(93.7)	23(6.3)	
30-34	232(28.5)	202(87.1)	30(12.9)	
≥35	100(12.3)	93(93.0)	7(7.0)	
Pre-pregnant BMI				**0.002**
Thin (BMI<18.5 kg/m^2)	165(20.4)	158(95.8)	7(4.2)	
Normal (BMI of 18.5-23.9 kg/m^2)	542(67.1)	479(88.4)	63(11.6)	
Overweight/obesity (BMI >23.9 kg/m^2)	101(12.5)	97(96.0)	4(4.0)	
Marital Status				0.527[a]
Single/divorced/widowed	37(4.6)	32(86.5)	5(13.5)	
Married	776(95.4)	706(91.0)	70(9.0)	
Working Status				0.838
Unemployment	214(26.3)	195(91.1)	19(8.9)	
Employment	599(73.7)	543(90.7)	56(9.3)	
Education level				0.577
Junior middle school or below	158(19.4)	140(88.6)	18(11.4)	
High school or technical secondary school	183(22.5)	167(91.3)	16(8.7)	
College or above	472(58.1)	431(91.3)	41(8.7)	
Per-capita monthly income, ¥				0.603

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≤3000	73(9.0)	64(87.7)	9(12.3)
3001-7999	572(70.3)	520(90.9)	52(9.1)
≥8000	168(20.7)	154(91.7)	14(8.3)
Relationship with mother-in-law			0.000
Poor	27(3.3)	22(81.5)	5(18.5)
Moderate	263(32.3)	226(85.9)	37(14.1)
Good	523(64.3)	490(93.7)	33(6.3)
Method of pregnancy			0.034[a]
Artificial insemination	33(4.1)	26(78.8)	7(21.2)
Spontaneous pregnancy	780(95.9)	712(91.3)	68(8.7)
Planned Pregnancy			0.291
No	333(41.0)	298(89.5)	35(10.5)
Yes	480(59.0)	440(91.7)	40(8.3)
Parity			0.201
0	338(41.6)	314(92.9)	24(7.1)
1	413(50.8)	368(89.1)	45(10.9)
≥2	62(7.6)	56(90.3)	6(9.7)
Number of Abortions			0.112
0	520(64.0)	480(92.3)	40(7.7)
1	114(14.0)	99(86.8)	15(13.2)
≥2	179(22.0)	159(88.8)	20(11.2)
Exercise			0.001
No	70(8.6)	56(50)	14(20.0)
Yes	743(91.4)	682(91.8)	61(8.2)
PSQI			0.000
Bad	200(24.6)	163(81.5)	37(18.5)

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Good	613(75.4)	575(93.8)	38(6.2)	
PAGAR				**0.000**
Serious Difficulty	66(8.1)	49(74.2)	17(25.8)	
Moderate Difficulty	256(31.5)	234(91.4)	22(8.6)	
Well	491(60.4)	455(92.7)	36(7.3)	
GSES				**0.000**
Low Level	184(22.6)	151(82.1)	33(17.9)	
Medium Level	495(60.9)	461(93.1)	34(6.9)	
High Level	134(16.5)	126(94.0)	8(6.0)	
Domestic violence				0.107
Yes	77(9.5)	66(85.7)	11(14.3)	
No	736(90.5)	672(91.3)	64(8.7)	
SSRS				**0.000**
< 39	367(45.1)	313(85.3)	54(14.7)	
≥39	446(54.9)	425(95.3)	21(4.7)	
Anxiety				**0.000**
Yes	64(7.9)	30(46.9)	34(53.1)	
No	749(92.1)	708(94.5)	41(5.5)	

* Continuity Correction.

For ease of reading, only the variables included in the binary logistic analysis was shown

(*P* < 0.05).

Abbreviations: PSQI, Pittsburgh sleep quality index; APGAR, Family Adaptation

Partnership Growth and Resolve Index; GSES, Self-efficacy Scale; SSRS, Social Support

Rating Scale.

3.2 The influencing factors of depressive symptoms in late pregnancy.

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The results of Chi-square test showed that age, pre-pregnancy BMI, relationship with mother-in-law, mode of conception, exercise during pregnancy, sleep quality, self-efficacy, social support and anxiety were significantly correlated with depression symptoms in late pregnancy (all $P<0.05$).The results were shown in Table 1.

Multivariate binary logistic regression results show that women age between 25 to 29 years (OR = 0.398, 95% CI 0.16,0.991), with poor relationships with their mother-in-law (OR=5.309, 95% CI 1.122,4.184), artificial insemination during pregnancy (OR = 4.339, 95%CI 1.492,12.623), no exercise during pregnancy (OR=2.666, 95%CI 1.177,6.039), low self-efficacy(OR=4.253, 95%CI 1.518,11.916), low social support (OR=2.371, 95%CI 1.206,4.661), poor sleep quality (OR=2.134, 95%CI 1.131,4.027) and anxiety symptoms (OR=17.654, 95%CI 8.494,36.689) were associated with depression symptoms during pregnancy. The results were shown in Table 2.

Table 2.

Factors associated with depression symptoms in late pregnancy(N=813).

Variables	β	Wald	p Value	OR (95%CI)
Age				
≤24				Reference
25-29	**-0.921**	**3.919**	**0.048**	**0.398(0.160–0.991)**
30-34	0.544	1.343	0.247	1.723(0.686–4.326)
≥35	-0.053	0.007	0.932	0.949(0.284–3.171)
Relationship with mother-in-law				
Poor	-0.890	1.334	0.248	0.411(0.091–1.859)
Moderate	**0.773**	**5.309**	**0.021**	**2.167(1.122–4.184)**
Good				Reference
Method of conception				
Artificial insemination	**1.468**	**7.257**	**0.007**	**4.339(1.492–12.623)**
Spontaneous pregnancy				Reference

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Exercise				
No	**0.980**	**5.522**	**0.019**	**2.666 (1.177–6.039)**
Yes				Reference
PSQI				
Bad	**0.758**	**5.476**	**0.019**	**2.134(1.131–4.027)**
Good				Reference
GSES				
Low Level	**1.448**	**7.582**	**0.006**	**4.253(1.518–11.916)**
Medium Level	0.408	0.674	0.412	1.504(0.568–3.985)
High Level				Reference
SSRS				
< 39	**0.863**	**6.271**	**0.012**	**2.371(1.206–4.661)**
≥39				Reference
Anxiety				
No				Reference
Yes	**2.871**	**59.166**	**0.000**	**17.654(8.494–36.689)**

4. Discussion

4.1 The prevalence of depression symptoms

The positive rate of depression symptoms in the third trimester was 9.2%, lower rates of depression symptoms than any other country in the world. The positive rate of depression symptoms (18%) reported in Pakistan[20], and the positive rate of depression symptoms (46.8%) reported in Thailand [21]. The main reasons for this result are cultural and demographic differences between countries, as well as the adaptability of different scales[22], Under the influence of China's "Saving face culture", pregnant women tend to hide their negative emotions in order not to be seen as weak or discriminated against, which leads researchers to underestimate the positive rate of depression and anxiety symptoms in this group,

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making our results different from those of other countries.

4.2 The influencing factors of depression symptoms in late pregnancy.

Pregnant women between the ages of 25 and 29 had a lower risk of depression than younger group, this was in contrast to a meta-analysis in Ethiopia that reported that pregnant women between 20 and 29 were more likely to have symptoms of prenatal depression[23] , probably because of differences in cultural and educational levels between the two countries. Most pregnant women in this age group already had work experience, so they were less worried about finding a job after becoming pregnant. In china, the legal age for marriage and childbirth was 20, so they were more likely to experience having children and had more knowledge and skills about pregnancy and childbirth[24]. In addition, women aged 25 to 29 have higher levels of psychological and physical maturity and are better able to withstand stressful life events and prevent depression symptoms.

As a special culture of developing countries, the relationship culture between mother-in-law and daughter-in-law has been discussed in other articles, and the results were similar to ours [25 26]. In our study, pregnant women with moderate relationships were more than twice as likely to have symptoms of prenatal depression as women with good relationships. In Chinese culture, people were not easy to report or admit that they had relationship friction or poor relationship with others. Most people were used to using moderate relationship as a substitute, which led to greater risks for pregnant women who have moderate relationship with their mothers-in-law. Due to the one-child policy implemented in China in the 1980s, the relationship between parents and children was an important part of the family relationship, and coupled with the influence of family culture and intergenerational transfer, it was common for women to live with their in-laws after marriage in less developed areas[27]. Due to the differences in age, culture, education and living habits, the two were prone to conflict, but since there was no blood ties, and living together for a long time. The friction between mother-in-law and daughter-in-law, coupled with the pregnant s concern about the conflict, was likely to continue to affect the pregnant woman's mood and produce depression symptoms[26 28].

Artificial insemination was a risk factor for depression symptoms and has a significant impact on the

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mental health of pregnant women. The main reason for artificial insemination was infertility, and women were more likely to feel the stress of infertility[29]. Because of China's outdated culture of "having a boy to carry on the family line", so artificial insemination, as a manifestation of fertility pressure, continued to affect the mental health of pregnant women[30]. After successful artificial insemination, the state of pregnancy became the focus of attention of oneself and the family, worried about the fatal, which made the pregnant woman of artificial insemination have more worry and excessive tension than the pregnant woman of natural pregnancy[31].

Women who did not exercise during pregnancy might be at greater risk for depression, and exercised during pregnancy could be effective in preventing depression symptoms. Exercise had positive cognitive and emotional benefits while reduced pain and negative effects[32].

Perinatal depression symptoms were associated with low self-efficacy in pregnant women, which was related to the mediating effect of self-efficacy on social support, pregnancy stress and depression symptoms[33]. Pregnant women with high levels of self-efficacy could actively face of stressful events in life, was more advantageous to enhance self-efficacy, thus effectively regulate mood, the prevention of depression symptoms.

Consistent with other findings, poor sleep quality was associated with depression symptoms in late pregnancy of pregnancy[34]. Due to the night urine, fetal movement, leg cramps and other symptoms, the number and time of the pregnant women waked up at night would increase, the sleep time shortened, resulted in poor sleep quality, depression symptoms was related to sleep disorders in the late pregnancy [35].

Lack of social support were risk factors of depression symptoms, pregnant woman could direct effects on depression of pregnant women [36 37]. As an important social resource for pregnant women, social support function was the social determinant of mental health. Positive social support made people feel concerned, loved and valued, which could improve the quality of life of pregnant women and promote their mental health[38 39].

Consistent with the results of previous studies, pregnant women with anxiety during pregnancy were more likely to suffer from depression symptoms[9 40]. Depression and anxiety symptoms have

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similarities, so they were often found to coexist [41]. In addition, different emotional problems would affect each other, increased the risk of other emotions[9].

5. Limitation

The limitations of this study was that cross-sectional data were used to determine the causal relationship between risk factors and depressive, and there were options in the questionnaire that needed to be filled by participants recalled the situation of the last week, month or year, so there was recall bias. However, this questionnaire selected a measurement tool with certain reliability and validity to minimize this problem. One more, the data were from women in the late pregnancy of urban pregnancy in Hengyang city, which couldn't be extended to rural areas. However, due to the urbanization process and intergenerational transfer process in China, this study had greater predictive significance. In addition , After screening pregnant women with depression symptoms, no further diagnosis and intervention was performed.

6. Conclusion

Our study reported that the prevalence rate of depression symptoms was 9.2% in pregnant women in Hengyang city. The influencing factors were age, relationship with the mother-in-law, mode of pregnancy, exercise during pregnancy, sleep quality, self-efficacy, social support, and symptoms of anxiety symptoms. This suggested that the medical institutions should add mental health screening tools in pregnancy examination to realize early discovery, early diagnosis and early treatment; When implementing maternal health care in medical institutions and community health service institutions, we should pay attention to the psychological status of pregnant women, provide them with targeted maternal health nursing.

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Disclaimer

The views expressed in this article belong to the authors and are not to the official position of any

other institution or funder.

Ethical Statement

The study has been approved by the Ethics Committee of the Xiangya school of Public Health, Central

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Conflict of interest

None

Author Contributions

Yunhan yu, Xidi zhu, Zhao hu: Conceptualization, Methodology, Software; Yunhan Yu: Data

curation, Writing, Original draft preparation, Reviewing; Yunhan yu, Xidi zhu, Zhao hu, Wensu zhou,

Baohua zheng, Shilin yin: Visualization, Investigation; Huilan xu: Supervision.

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	page
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			**2-3**
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2-3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			**3-4**
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	3-4
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4-6
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6

Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	6
		Case-control study—If applicable, explain how matching of cases and controls was addressed	
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	

Results			**6-15**
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	4
		(b) Give reasons for non-participation at each stage	4
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6-9
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	7
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	

Discussion			**11-14**
Key results	18	Summarise key results with reference to study objectives	11-13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14c
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

BMJ Open

Prevalence of depression symptoms and its influencing factors among pregnant women in late pregnancy in urban areas of Hengyang City, Hunan Province, China: a cross-sectional study

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1 **Prevalence of depression symptoms and its influencing factors among pregnant women in late**

2 **pregnancy in urban areas of Hengyang City, Hunan Province, China: a cross-sectional study**

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9 **Word count:** 3606 words.

10 **ABSTRACT**

11 **Objectives:** To evaluate the prevalence of depressive symptoms and its influencing factors in late

12 pregnancy.

13 **Design:** Cross-sectional study.

14 **Setting:** Fourteen community in urban areas of Hengyang City.

15 **Participants:** The study conducted from July to October 2019, and surveyed 813 women in late

16 pregnancy who lived in urban areas of Hengyang for more than 6 months, signed informed an informed

17 consent, and were and were without cognitive disorders, severe mental illnesses or other serious diseases.

18 **Measures:** Perinatal depression symptoms were evaluated using the Patient Health Questionnaire-9

19 (PHA-9), and perinatal anxiety symptoms were evaluated using the Generalized Anxiety Disorder Scale-

20 7 (GAD-7). Sociodemographic variables, obstetric characteristics, lifestyle behaviors, family factors,

21 social support, sleep quality, and self-efficacy were obtained through structured questionnaires.

22 **Results:** The prevalence of depression symptoms among pregnant women in late pregnancy was 9.2%

23 (95% confidence interval, CI: 7.2%,11.2%). Protective factor: Age between 25 to 29 years (OR = 0.398;

24 95% CI 0.16,0.991). Risk factors: a normal relationship with her mother-in-law (OR=5.309; 95% CI

25 1.122,4.184), artificial insemination (OR=4.339; 95% CI 1.492,12.623), no exercise during pregnancy

26 (OR=2.666, 95% CI 1.177,6.039), low self-efficacy (OR=4.253; 95% CI 1.518,11.916), low social

27 support (OR=2.371; 95% CI 1.206,4.661), poor sleep quality (OR=2.134; 95% CI 1.131,4.027),

1

1 existence of anxiety symptoms (OR=17.654; 95% CI 8.494,36.689).

2 **Conclusion:** The prevalence of depression symptoms is lower than that in developing countries, but due

3 to the large population base of China, the problem should still be taken seriously. To prevent mental

4 disorders of pregnant women, early screening for mental disorders, promotion of healthy lifestyles,

5 mental health care during pregnancy, and improved family and social support should be implemented

6 during pregnancy nursing.

7 *Keywords:* Depression symptoms; Late pregnancy; Prevalence; Influencing factors; China

Article Summary

Strengths and limitations of the study

Strengths:

1. This study investigated the depression symptoms of pregnant women after excluding pregnancy

complications and explored a wide range of influencing factors, including psychological,

physiological and social aspects.

2. This study was a larger sample size than other studies in China; the sample was from the

community and avoided hospital bias.

Limitations:

1. The disadvantage of this study is that the cross-sectional design cannot determine the causal

relationship between the influencing factors and depressive symptoms.

2. The participants' recall may lead to recall bias.

8

9 **1. Introduction**

10 Pregnant women undergo role, physiological and psychological changes. Physiological problems may

11 occur during pregnancy, such as constipation, sleepiness, physiological dyspnea, and hormone level

12 fluctuation, while physiological discomfort, hormonal effects and changes in social roles may cause

13 cognitive, behavioral and emotional changes in pregnant women, resulting in mental health problems.

14 These issues are likely to continue to postpartum and can lead to more serious psychological health and

15 fetal adverse outcomes and developmental problems [1,2]. The gestation period includes the first trimester

2

(before the 13th weekend), the second trimester (between the 14th and 17th weekends), and late

pregnancy (28 weeks and beyond). Because of the increase of pregnancy duration in late pregnancy,

pregnant women's sleep time is shortened, and snoring and the number and times of waking up at night

are increased, leading to poor sleep quality and affecting the emotional regulation mechanism of

pregnant women[3]. Studies have shown that women in their third trimester worried more about their

baby's health and delivery and were at increased risk for depression symptoms[4]. Therefore, it is of great

significance to consider antenatal mental health status and to determine its potential influencing factors

by investigating pregnant women in late pregnancy.

There has been a wide range of discussion on prenatal depression. Prenatal depression is a mental

disorder during pregnancy characterized by persistent low mood, slow thinking and exercise inhibition.

However, the prevalence rates of these conditions were different in different countries based on their

measurements and culture background variations. A systematic review performed by retrieving

observational studies at three different time periods found that the incidence of depression symptoms in

late pregnancy was 12%[5]. However, a meta-analysis of prenatal depression in Ethiopia showed that the

combined prevalence of prenatal depression was 21.28% (95% *CI*;15.96-27.78), and the highest

prevalence of depressive symptoms was 32.10% in late pregnancy, with 19.13% in the first trimester

and 18.86% in the second trimester[6].

From personal and social perspectives, associated factors for depression in pregnant women mainly

included four domains: (1) sociodemographic factors; (2) pregnancy characteristics; (3) personality

characteristics and (4) psychosocial factors. For sociodemographic factors such as age, for example, a

study on depression symptoms among pregnant women in the middle and third trimesters showed that

the younger they are, the higher the positive rate of depression symptoms they have[7]. Pregnancy

characteristics such as planned pregnancy [8] and history of abortion[9] and personality traits such as low

self-efficacy were related to prenatal depression[10]. Psychosocial factors such as socioeconomic status,

social support and life events were associated with mental health during pregnancy [11].

Existing research on depression has been more focused on postpartum; reports of depression

symptoms in late pregnancy have been less common, and most of them have explored the situation from

3

1   a single dimension using minor specimens. Therefore, the purpose of the current study was to describe

2   the prevalence of depression symptoms in late pregnancy and to comprehensively analyze its influencing

3   factors. The results of this study may provide scientific basis for the evaluation of mental health status

4   in a prepregnancy examination program and mental health care service to prevent the symptoms of

5   depression in pregnant women.

6

7   **2. Methods**

8   *2.1. Design and participants*

9   This was a cross-sectional survey of pregnant women in late pregnancy in urban areas of Hengyang

10   City, Hunan Province, China, conducted from July to October 2019. The sampling method was a

11   multistage cluster random sampling method. There are 5 administrative districts in urban Hengyang. In

12   the first stage, one street was randomly selected in each district. In the second stage, because the

13   minimum number of communities on a street is 3, 14 communities were randomly selected according

14   to a ratio of 1:3, including 4 communities from Zhengxiang street, 3 communities from Qingshan street,

15   3 communities from Baishazhou street, 2 communities from Guangdong road street and 2 communities

16   from Zhurong street.

17   Inclusion criteria: pregnant women in late pregnancy who had lived in urban areas of Hengyang for

18   more than 6 months and had signed informed consent (gestational week: 28 weeks and beyond).

19   Exclusion criteria: Women with cognitive disorders, severe mental illnesses or other serious diseases

20   and those who could not fill out the questionnaire by themselves.

21   The sample size was estimated using the sample size calculation formula for cross-sectional studies.

22   According to previous studies, the prevalence of depression symptoms among pregnant women in late

23   pregnancy was 32.1%[6]. In this study, with admissible error $d=0.1p$, $p=0.05$, $\alpha=0.05$, the minimum

24   theoretical sample size for the study was calculated to be approximately 812 people. In fact, 813

25   pregnant women completed the survey by filling in a paper or electronic WeChat questionnaire after

26   informed consent was obtained, and the results were further analyzed.

27

4

1   *2.2 Measurement*

2   2.2.1 Demographic characteristics

3   The self-report questionnaire was used to obtain demographic information of pregnant women,

4   including age, ethnicity, marital status, her and her husband's education, occupation, per-capita monthly

5   income, and medical expenses payment methods.

6   2.2.2 Pregnancy characteristics and lifestyle

7   Pregnancy characteristics included parity (0, 1, ≥2), methods of pregnancy (Artificial

8   insemination/Spontaneous pregnancy), whether planned pregnancy, pregnancy complications

9   (including gestational hypertension, gestational diabetes, intrahepatic cholestasis, cervical disease),

10   number of abortions (0, 1, ≥2), and whether regular antenatal examinations were performed.

11   Lifestyle included pre-pregnancy body mass index (Pre-BMI), her and her husband's smoking habits,

12   her and her husband's drinking habits, and exercise. Prepregnancy BMI was based on the pregnant

13   woman's self-reported height and weight before and after pregnancy using China's classification of thin

14   (BMI<18.5 kg/m^2), normal weight (BMI of 18.5-23.9 kg/m^2), and overweight (BMI >23.9 kg/m^2).

15   Smoking was defined as an average of one cigarette a day for the past year. Drinking was defined as

16   drinking alcohol on average once a week. Exercise was defined as walking, yoga, or other forms during

17   the past week, Yes or No.

18   2.2.3 Outcome measurements

19   Depression symptoms in late pregnancy were assessed using the Patient Health Questionnaire (PHQ-

20   9). This questionnaire has been widely used in clinical and observation studies with good reliability and

21   validity. There are 9 items in this questionnaire, and the score of each item is set to 0-3, with a total

22   score of 27. The higher the score, the more obvious the depression symptoms are, with a total score ≥10

23   considered to be depression symptoms[12,13], with a Cronbach's α coefficient of 0.773.

24   2.2.4 Family factors

25   Family factors include family function, the relationship with the mother-in-law and experience of

26   domestic abuse. Family function was assessed using the Family Adaptation Partnership Growth and

27   Resolve Index (APGAR). The APGAR scale contains five items and five dimensions, respectively

5

1 reflecting the adaptability, cooperation, maturity, affection and affinity of family functions. Each item

2 was scored using a 3-point Likert scale, with a total score of 0-10, with a score of 7-10 indicating good

3 family function, 4-6 indicating moderate family function disorder, and 0-3 indicating severe family

4 function disorder[14]. APGAR is widely used and has good reliability and validity in pregnant women in

5 China[15], with a Cronbach's α coefficient of 0.876 in this study. The Abuse Assessment Screen (AAS)

6 was used to assess domestic violence during pregnancy. Eight items were used to assess exposure to

7 domestic violence in the past year and during pregnancy, including physical, emotional and sexual

8 violence. The respondents answered 'yes' to items 3/4/5/6/7; the total number of times of abuse was

9 more than three times, subjective pain, and the three conditions were considered to have experienced

10 domestic violence[16]. Research shows that the AAS questionnaire has good reliability and validity in

11 pregnant women, with a Cronbach's α coefficient of 0.685 in this study.

12 2.2.5 Other relevance factors

13 The Social Support Rating Scale (SSRS) [17]was used in this study to evaluate the status of social

14 support for pregnant women, as introduced by Xiao, and included objective support, subjective support

15 and the availability of support. A higher score means higher social support. A total score less than 39 in

16 this study was considered as low social support. The scale has good reliability and validity, with a

17 Cronbach's α coefficient of 0.705 in this study.

18 This study used the Pittsburgh sleep quality index (PSQI) to evaluate maternal sleep quality. The total

19 score of PSQI is between 0 and 21 points, and the higher the score, the worse the sleep quality. PSQI

20 scores ≤7 were rated as "good sleep quality", while PSQI scores >7 were rated as "poor sleep quality".

21 Studies have shown that the PSQI scale has good reliability and validity in evaluating sleep quality [18],

22 and the Chinese version of the PSQI questionnaire has been widely accepted as a sleep quality

23 assessment method in mainland China, with a Cronbach's α coefficient of 0.789 in this study.

24 The Self-efficacy Scale (GSES) was used to evaluate pregnant women's self-efficacy. The GSES was

25 developed by German health psychology and clinical experts Ralf and Schwarzer and was translated

26 into Chinese by JianXin Zhang [19]. This scale is a single-dimension scale with 10 items. Each item has 4

27 options: completely incorrect, moderately correct, mostly correct and completely correct, marked as l,

6

1 2, 3 and 4, with the total score ranging from 10 to 40. The total score is divided by the total score of 10

2 items into low level (0-2), medium level (2.1-3), and high level (3.1-4). The higher the score, the better

3 the self-efficacy is. The Cronbach ' α coefficient of this scale was 0.898 in this study.

4   The Generalized Anxiety Disorder scale-7 (GAD-7) was used in this study to evaluate the anxiety of

5 women in late pregnancy. This table was developed by Spitzer et al. 2006 and consisted of 7 items for

6 screening generalized anxiety disorder[20]. Participants were asked if they had experienced seven

7 symptoms in the past two weeks, with each item being scored on a scale of four, "0= not at all", "1=

8 days", "2= more than half days", and "3= almost every day", with a score ranging from 0 to 21. Studies

9 have shown that using a cut-off score of 10 is a good way to distinguish anxiety from non-anxiety[21]. In

10 our study, the Cronbach's α coefficient was 0.773.

11

12 *2.3 Ethical considerations*

13   All respondents gave written informed consent before entering the study and volunteered for the

14 survey. The study was approved by the Ethics Committee of the Xiangya School of public Health,

15 Central South University (XYGW-2019-056), prior to the field investigation.

16

17 *2.4 Statistical analysis*

18   SPSS version 25.0 was used to collate and analyze the data. Continuous variables were converted into

19 categorial variables by referring to the literature and combining research purposes, and all categorical

20 variables are described as counts and percentages. Univariate analysis used the Chi-square test or

21 Fisher's test to analyze the relationship between sociodemographic characteristics, pregnancy

22 characteristics, lifestyle, family factors, social support, sleep quality, self-efficacy with depressive

23 symptoms and compared the characteristics of between the depression symptoms and nondepression

24 symptoms groups. A multivariate binary logistic regression with odds ratios (ORs) was used to analyze

25 the influencing factors of prenatal depression symptoms. Depression symptoms were taken as dependent

26 variables, and factors with statistical significance ($P < 0.05$) in the univariate analysis were taken as

27 independent variables, including age (≤ 24, 25-29, 30-34, ≥ 35), pre-BMI (thin, normal, overweight),

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1   exercise (yes or no), relationship with mother-in-law (bad, general, good), family function (serious

2   difficulty, moderate difficulty, well), social support (high or low), sleep quality (good or poor), and self-

3   efficacy (low, medium, high). All statistical tests were 2-sided.

4

5   *2.5 Patient and public involvement*

6   Patients and the public were not involved in the design of this study.

7

8   **3. Results**

9   *3.1 Participants*

10   Fourteen communities had 819 women in late pregnancy who were registered in community health

11   service centers, but 3 women in late pregnancy did not conform to the inclusion criteria (n=816), and

12   three pregnant women did not complete the questionnaire and refused to participate in the survey

13   (n=813), for a refusal rate of 0.36%. The sampling process is shown in Figure 1.

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16

17   *3.2 Sample characteristics*

18   All participants were aged 17-54 years (mean=29). Most of them were ethnic Han (98.2%). Most

19   were in the state of marriage (95.4%). More than half had college/university and above as their highest

20   education (58.1%). Most of the pregnant women were working during pregnancy (73.7%). More than

21   half of their husbands had college/university education and above (59.9%). Most of the husbands were

22   working (98.3%). The per-capita monthly income was between 3001-7999 yuan for 70% of households.

23   The majority of pregnant women (72.8%) were covered by medical insurance, as shown in Table 1. A

24   total of 41.6% were pregnant for the first time. The vast majority (95.9%) of pregnant women conceived

25   naturally. More than half (59%) were in a planned pregnancy. More than half (64.0%) of pregnant

26   women had no history of miscarriage. Most of the pregnant women were without pregnancy

27   complications (89.5%). The vast majority of pregnant women received regular prenatal examinations

8

1 (91.4%). The prepregnancy BMI was normal for 67.1% of pregnant women. A total of 91.4% of

2 participants exercised during pregnancy, and the results are shown in Table 2. More than half (64.3%)

3 of the pregnant women had a good relationship with their mother-in-law, and 60.4% of the pregnant

4 women had good family function. Most of the pregnant women (90.5%) did not experience violence

5 during pregnancy. A total of 75.4% of the pregnant women had good sleep quality. More than half

6 (54.9%) of the pregnant women had a high level of social support, and 60.9% of their self-efficacy was

7 in the medium level; the results are shown in Table 3. In our study, the prevalence rates of depression

8 symptoms and anxiety symptoms were 9.2% and 7.9%, respectively. The results are shown in Table 1

9 and Table 3.

10

11 Table 1

12 Demographic information of pregnant women and distribution of depression symptoms (N=813).

Characteristic	Total	Depression symptoms		p Value
	n(%)	NO n(%)	YES n(%)	
N	813(100.0)	738(90.8)	75(9.2)	
Age				**0.017**
≤24	115(14.1)	100(87.0)	15(13.0)	
25-29	366(45.1)	343(93.7)	23(6.3)	
30-34	232(28.5)	202(87.1)	30(12.9)	
≥35	100(12.3)	93(93.0)	7(7.0)	
Ethnicity				1.000[a]
Minority	15(1.8)	14(93.3)	1(6.7%)	
Han ethnicity	798(98.2)	724(90.7)	74(9.3)	
Marital status				0.527[a]
Single/divorced/widowed	37(4.6)	32(86.5)	5(13.5)	
Married	776(95.4)	706(91.0)	70(9.0)	

9

Characteristic	Total			p Value
Education level				0.577
Junior middle school or below	158(19.4)	140(88.6)	18(11.4)	
High school or technical secondary school	183(22.5)	167(91.3)	16(8.7)	
College or above	472(58.1)	431(91.3)	41(8.7)	
Working status				0.838
Unemployed	214(26.3)	195(91.1)	19(8.9)	
Employed	599(73.7)	543(90.7)	56(9.3)	
Education level (Husband)				0.704
Junior middle school or below	122(15.0)	111(91.0)	11(9.0)	
High school or technical secondary school	204(25.1)	188(92.2)	16(7.8)	
College or above	487(59.9)	439(90.1)	48(9.9)	
Working status (Husband)				
Unemployed	14(1.7)	14(100.0)	0(0.0)	
Employed	799(98.3)	724(90.6)	75(9.4)	
Per-capita monthly income, ¥				0.603
≤3000	73(9.0)	64(87.7)	9(12.3)	
3001-7999	572(70.3)	520(90.9)	52(9.1)	
≥8000	168(20.7)	154(91.7)	14(8.3)	
Medical expenses payment methods				0.588[a]
Free	29(3.6)	28(96.6)	1(3.4)	
Out-of-pocket	192(23.6)	176(91.7)	16(8.3)	
Medical insurance	592(72.8)	534(90.2)	58(9.8)	

1

2   Table 2

3   Pregnancy characteristics and lifestyle of pregnant women (N=813).

Characteristic	Total	Depression symptoms	p Value

10

	n(%)	NO n(%)	YES n(%)	
Parity				0.201
0	338(41.6)	314(92.9)	24(7.1)	
1	413(50.8)	368(89.1)	45(10.9)	
≥2	62(7.6)	56(90.3)	6(9.7)	
Method of pregnancy				**0.034[a]**
Artificial insemination	33(4.1)	26(78.8)	7(21.2)	
Spontaneous pregnancy	780(95.9)	712(91.3)	68(8.7)	
Planned pregnancy				0.291
Yes	480(59.0)	440(91.7)	40(8.3)	
No	333(41.0)	298(89.5)	35(10.5)	
Number of abortions				0.112
0	520(64.0)	480(92.3)	40(7.7)	
1	114(14.0)	99(86.8)	15(13.2)	
≥2	179(22.0)	159(88.8)	20(11.2)	
Pregnancy complications				0.646
Yes	85(10.5)	76(89.4)	9(10.6)	
No	728(89.5)	662(90.9)	66(9.1)	
Regular antenatal examination				0.126
Yes	743(91.4)	678(91.3)	65(8.7)	
No	70(8.6)	60(85.7)	10(14.3)	
Prepregnancy BMI				**0.002**
Thin	165(20.4)	158(95.8)	7(4.2)	
Normal	542(67.1)	479(88.4)	63(11.6)	
Overweight/obesity	101(12.5)	97(96.0)	4(4.0)	
Exercise				**0.001**
Yes	743(91.4)	682(91.8)	61(8.2)	

11

No	70(8.6)	56(50)	14(20.0)	

1

2   Table 3

3   Family factors and other relevance factors of pregnant women (N=813).

Characteristic	Total	Depression symptoms		*p* Value
	n(%)	NO n(%)	YES n(%)	
Relationship with mother-in-law				**< 0.001**
Bad	27(3.3)	22(81.5)	5(18.5)	
General	263(32.3)	226(85.9)	37(14.1)	
Good	523(64.3)	490(93.7)	33(6.3)	
Family function				**< 0.001**
Serious difficulty	66(8.1)	49(74.2)	17(25.8)	
Moderate difficulty	256(31.5)	234(91.4)	22(8.6)	
Well	491(60.4)	455(92.7)	36(7.3)	
Domestic violence				0.107
Yes	77(9.5)	66(85.7)	11(14.3)	
No	736(90.5)	672(91.3)	64(8.7)	
Sleep quality				**< 0.001**
Bad	200(24.6)	163(81.5)	37(18.5)	
Good	613(75.4)	575(93.8)	38(6.2)	
Self-efficacy				**< 0.001**
Low level	184(22.6)	151(82.1)	33(17.9)	
Medium level	495(60.9)	461(93.1)	34(6.9)	

12

High level	134(16.5)	126(94.0)	8(6.0)
Social support			**< 0.001**
Low	367(45.1)	313(85.3)	54(14.7)
High	446(54.9)	425(95.3)	21(4.7)
Anxiety symptoms			**< 0.001**
Yes	64(7.9)	30(46.9)	34(53.1)
No	749(92.1)	708(94.5)	41(5.5)

1

2   [a] Continuity Correction.

3   *3.3 Influencing factors of depressive symptoms in late pregnancy.*

4   The results of Chi-square test showed that age, prepregnancy BMI, relationship with mother-in-

5   law, mode of conception, exercise during pregnancy, sleep quality, self-efficacy, social support and

6   anxiety symptoms were significantly correlated with depression symptoms in late pregnancy (all

7   *P*<0.05). The results are shown in Tables 1, 2, and 3.

8   Multivariate binary logistic regression results show that in women, the odds of prenatal depression

9   symptoms were reduced by age between 25 to 29 years (OR = 0.398, 95% CI 0.16,0.991), and the odds

10   of prenatal depression symptoms were increased by artificial insemination during pregnancy (OR =

11   4.339, 95% CI 1.492,12.623), no exercise during pregnancy (OR=2.666, 95% CI 1.177,6.039), poor

12   relationships with their mother-in-law (OR=5.309, 95% CI 1.122,4.184), poor sleep quality (OR=2.134,

13   95% CI 1.131,4.027), low self-efficacy (OR=4.253, 95% CI 1.518,11.916), low social support

14   (OR=2.371, 95% CI 1.206,4.661), and anxiety symptoms (OR=17.654, 95% CI 8.494,36.689). The

15   results are shown in Table 4.

16

17

18   Table 4.

19   Factors associated with depression symptoms in late pregnancy(N=813).

13

Variables	β	Wald	*p* Value	OR (95%CI)
Age				
≤24				Reference
25-29	**-0.921**	**3.919**	**0.048**	**0.398(0.160–0.991)**
30-34	0.544	1.343	0.247	1.723(0.686–4.326)
≥35	-0.053	0.007	0.932	0.949(0.284–3.171)
Method of conception				
Artificial insemination	**1.468**	**7.257**	**0.007**	**4.339(1.492–12.623)**
Spontaneous pregnancy				Reference
Exercise				
No	**0.980**	**5.522**	**0.019**	**2.666 (1.177–6.039)**
Yes				Reference
Relationship with mother-in-law				
Poor	-0.890	1.334	0.248	0.411(0.091–1.859)
Moderate	**0.773**	**5.309**	**0.021**	**2.167(1.122–4.184)**
Good				Reference
Sleep quality				
Bad	**0.758**	**5.476**	**0.019**	**2.134(1.131–4.027)**
Good				Reference
Self-efficacy				
Low level	**1.448**	**7.582**	**0.006**	**4.253(1.518–11.916)**
Medium level	0.408	0.674	0.412	1.504(0.568–3.985)
High level				Reference
Social support				
Low	**0.863**	**6.271**	**0.012**	**2.371(1.206–4.661)**
High				Reference

14

Anxiety				
No				Reference
Yes	**2.871**	**59.166**	**0.000**	**17.654(8.494–36.689)**

1

2

3 **4. Discussion**

4 *4.1 The prevalence of depression symptoms*

5   The prevalence of depression symptoms in late pregnancy was 9.2% (95% CI: 7.2%,11.2%),

6 indicating lower rates of depression symptoms than those in other developing countries, such as the

7 prevalence rates of depression symptoms reported in Pakistan (18%) [22] and in Thailand (46.8%) [23]. The

8 main reasons for this result are cultural and demographic differences between countries, as well as the

9 adaptability of different scales[24]. Under the influence of China's "Saving face culture", people generally

10 have the idea that one should not wash one's dirty linen in public. They are often reluctant to show their

11 weaknesses and bad emotions to outsiders to maintain their own good image and maintain the family's

12 sense of honor and reputation. Thus, pregnant women tend to hide their negative emotions so as not to

13 be seen as weak or discriminated against, which leads researchers to underestimate the positive rates of

14 depression and anxiety symptoms in this group, making our results different from those of other

15 countries.

16

17 *4.2 The influencing factors of depression symptoms in late pregnancy.*

18 *4.2.1 Sociodemographic factors*

19   Pregnant women between the ages of 25 and 29 had a lower risk of depression than a younger group,

20 in contrast to a meta-analysis in Ethiopia that reported that pregnant women between 20 and 29 were

21 more likely to have symptoms of prenatal depression[6], probably because of differences in cultural and

22 educational levels between the two countries. Most pregnant women in this age group already had work

23 experience; thus, they were less worried about finding a job after becoming pregnant. In China, the legal

24 age for marriage and childbirth is 20; thus, they were more likely to experience having children and had

15

1 more knowledge and skills about pregnancy and childbirth[25]. In addition, women aged 25 to 29 have

2 higher levels of psychological and physical maturity and are better able to withstand stressful life events

3 and prevent depression symptoms.

4

5 *4.2.2 Pregnancy characteristics and lifestyle factors*

6 Artificial insemination was a risk factor for depression symptoms and has a significant impact on the

7 mental health of pregnant women. The main reason for artificial insemination was infertility, and women

8 were more likely to feel the stress of infertility[26]. Because of China's outdated culture of "having a boy

9 to carry on the family line", artificial insemination, as a manifestation of fertility pressure, continued to

10 affect the mental health of pregnant women[27]. After successful artificial insemination, the state of

11 pregnancy became the focus of attention of oneself and the family, with worries about loss of the

12 pregnancy, which made pregnant women who were artificially inseminated have more worry and

13 excessive tension than woman with natural pregnancy[28].

14 Women who did not exercise during pregnancy might be at greater risk for depression, and exercise

15 during pregnancy could be effective in preventing depression symptoms. Exercise had positive cognitive

16 and emotional benefits while reducing pain and negative effects[29].

17

18 4.2.3 *Family factors*

19 As a special culture of developing countries, the relationship culture between mother-in-law and

20 daughter-in-law has been discussed in other articles, and the results were similar to ours [30, 31]. In our

21 study, pregnant women with moderate relationships with their mother-in-law were more than twice as

22 likely to have symptoms of prenatal depression as women with good relationships. In Chinese culture,

23 people do not easily report or admit that they have relationship friction or poor relationships with others.

24 Most people were used to using moderate relationships as a substitute, which led to greater risks for

25 pregnant women who have moderate relationships with their mothers-in-law. Due to the one-child

26 policy implemented in China in the 1980s, the relationship between parents and children was an

27 important part of the family relationship, and coupled with the influence of family culture and

16

1 intergenerational transfer, it was common for women to live with their in-laws after marriage in less-

2 developed areas[32]. Due to the differences in age, culture, education and living habits, the two were prone

3 to conflict since there was no blood ties and because they lived together for a long time. The friction

4 between mother-in-law and daughter-in-law, coupled with the pregnant woman's concern about the

5 conflict, was likely to continue to affect the pregnant woman's mood and produce depression

6 symptoms[31,33].

7

8 *4.2.4 Other factors*

9 Perinatal depression symptoms were associated with low self-efficacy in pregnant women, which was

10 related to the mediating effect of self-efficacy on social support, pregnancy stress and depression

11 symptoms[34]. Pregnant women with high levels of self-efficacy could actively face stressful events in

12 life, which was more advantageous for enhancing self-efficacy and thus effectively regulating mood and

13 the prevention of depression symptoms.

14 Consistent with other findings, poor sleep quality was associated with depression symptoms in late

15 pregnancy[35]. Due to night urine, fetal movement, leg cramps and other symptoms, the number and time

16 pregnant women awakened during the night would increase, and the sleep time shortened, resulting in

17 poor sleep quality; thus, depression symptoms were related to sleep disorders in late pregnancy [36].

18 Lack of social support was a risk factor for depression symptoms; pregnant women could direct

19 the effects on depression of pregnant women [3,37]. As an important social resource for pregnant women,

20 social support function was a social determinant of mental health. Positive social support made people

21 feel concerned, loved and valued, which could improve the quality of life of pregnant women and

22 promote their mental health[38,39].

23 Consistent with the results of previous studies, pregnant women with anxiety during pregnancy

24 were more likely to suffer from depression symptoms[11,40]. Depression and anxiety symptoms have

25 similarities; therefore, they are often found to coexist [41]. In addition, different emotional problems would

26 affect each other, increasing the risk of other emotions[11].

27 **5. Limitation**

17

1   The limitations of this study were that cross-sectional data were used to determine the causal

2 relationship between risk factors and depression, and there were options in the questionnaire that needed

3 to be filled out by participants recalling the situations of the last week, month or year, meaning that there

4 was recall bias. However, this questionnaire selected a measurement tool with certain reliability and

5 validity to minimize this problem. Additionally, the data were from women in late pregnancy in an urban

6 area of Hengyang city; thus, the results could not be extended to rural areas. However, due to the

7 urbanization process and intergenerational transfer process in China, this study had greater predictive

8 significance. In addition, after screening pregnant women for depression symptoms, no further diagnosis

9 and intervention was performed.

10 **6. Conclusion**

11   Our study reported that the prevalence rate of depression symptoms was 9.2% in pregnant women in

12 Hengyang city. The influencing factors were age, relationship with the mother-in-law, mode of

13 pregnancy, exercise during pregnancy, sleep quality, self-efficacy, social support, and symptoms of

14 anxiety symptoms. These findings suggested that the medical institutions should add mental health

15 screening tools in pregnancy examinations to realize early discovery, early diagnosis and early treatment.

16 When implementing maternal health care in medical institutions and community health service

17 institutions, we should pay attention to the psychological status of pregnant women and provide them

18 with targeted maternal health nursing.

19

27

18

1 **Disclaimer**

2   The views expressed in this article belong to the authors and are not to the official position of any

3 other institution or funder.

4

5 **Ethical Statement**

6   The study has been approved by the Ethics Committee of the Xiangya School of Public Health,

7 Central South University, on 15 July 2019 (XYGW-2019-056).

8

9 **Conflict of interest**

10   None

11

12 **Author Contributions**

13   Yunhan yu, Xidi zhu, and Zhao hu: conceptualization, methodology, software; Yunhan Yu: data

14 curation, writing, original draft preparation, reviewing; Yunhan yu, Xidi zhu, Zhao hu, Wensu zhou,

15 Baohua zheng, and Shilin yin: visualization and investigation; Huilan xu: supervision.

16

17 **Data availability statement**

18 No additional data available

19

20 **Figure legends**

21 Figure 1 Sample flow chart
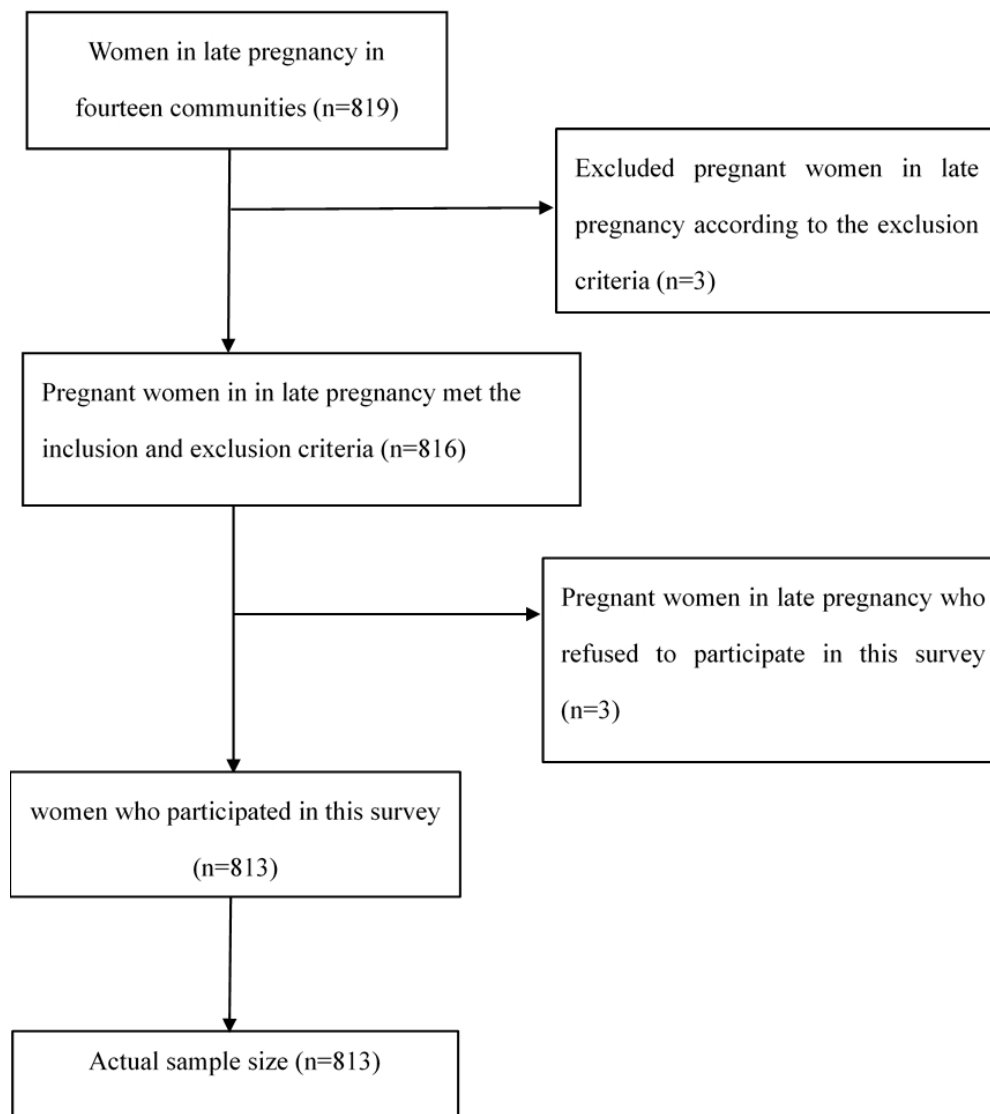
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┌─────────────────────────────┐
│  Women in late pregnancy in │
│                             │
│  fourteen communities (n=819)│
└─────────────────────────────┘
                │              ┌──────────────────────────────────┐
                │─────────────▶│ Excluded pregnant women in late  │
                │              │ pregnancy according to the       │
                │              │ exclusion criteria (n=3)         │
                ▼              └──────────────────────────────────┘
┌─────────────────────────────────────┐
│ Pregnant women in in late pregnancy │
│ met the inclusion and exclusion     │
│ criteria (n=816)                    │
└─────────────────────────────────────┘
                │              ┌──────────────────────────────────┐
                │─────────────▶│ Pregnant women in late pregnancy │
                │              │ who refused to participate in    │
                │              │ this survey (n=3)                │
                ▼              └──────────────────────────────────┘
┌─────────────────────────────────────┐
│ women who participated in this      │
│ survey (n=813)                      │
└─────────────────────────────────────┘
                │
                ▼
┌─────────────────────────────────────┐
│ Actual sample size (n=813)          │
└─────────────────────────────────────┘
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229x257mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	page
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			**2-4**
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2-3
Objectives	3	State specific objectives, including any prespecified hypotheses	3-4
Methods			**4-7**
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	4
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4-7
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4-7
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7

Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	7
		Case-control study—If applicable, explain how matching of cases and controls was addressed	
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	

Results			**8-14**
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	8
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-12
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	9-13
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-14
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	

Discussion			**14-17**
Key results	18	Summarise key results with reference to study objectives	15-16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18